MONTGUIDE
MT 9602 Agriculture

Alfalfa Weevil

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The alfalfa weevil is the most important damaging insect pest in alfalfa production systems. Although populations fluctuate from year to year, the insect is found in all production areas of Montana.

Monitoring the damaging, immature stage is key to making the best and most economical management decisions. When larval populations exceed the economic threshold, yield benefits outweigh the costs of treatment and an intervention is suggested.

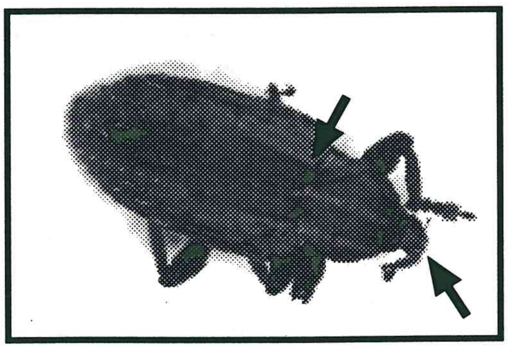

Figure 1: Alfalfa weevil adult

Figure 2: Alfalfa weevil eggs

Life history

The alfalfa weevil overwinters in the adult stage in leaf litter or around alfalfa crowns. The brown-grey beetle has a characteristic snout at the front of its head and a dark brown stripe down the middle of its back (*Figure 1*).

Typically, these are the most numerous beetles in alfalfa fields, but other snout beetles may be present. Adult alfalfa weevils become active when daytime temperatures reach or exceed 60ºF. Adult females chew holes in alfalfa stems and then insert clusters of eggs into the stem. Eggs may be found by locating an oviposition hole in a stem and splitting the stem open.

Eggs are usually laid in clusters consisting of five to 15 small (about 1/50th of an inch in length) bright yellow eggs (*Figure 2*). As eggs get closer to hatching, they darken, turning dark yellow/brown. Using a hand lens, black head capsules can be seen inside the egg just before hatching.

Eggs hatch after seven to 14 days, and the young larvae feed for a short time before crawling up the stem and feeding in plant terminals. Small instars feed in developing plant terminals, causing a characteristic shot-hole pattern as leaves expand. At this time, splitting the plant terminal open can reveal a small larvae.

Alfalfa Weevil, *Hypera postica*
Order: Coleoptera
Family: Curculionidae

- Larvae are the damaging stage of the alfalfa weevil
- Begin monitoring for larvae at 310 degree days (DD)
- Assess plant damage in addition to monitoring larvae
- Economic threshold:
  1.5 - 2 larvae/stem
  20 larvae/sweep
- Choose appropriate management techniques
- Continue monitoring under the windrow when early cutting is used for weevil larvae control

Small larvae have a characteristic black head capsule with a white to light-yellow colored body. As they grow, larvae acquire the more typical green body color with a white stripe down the middle of the back, retaining a black head capsule throughout the immature stages (*Figure 3, inside*).

Larger instars feed in more exposed sites, on expanded leaves

Degree days = [(daily minimum temp. + daily max.) / 2] - 48

Examples of degree day (DD) calculations and cumulations:

Temperatures Minimum	Maximum	Calculations	Degree Day (48°base)	Cumulative Degree Days
35	45	(35+45) / 2 - 48 = -8	0	0
44	56	(44+56) / 2 - 48 = 2	2	2
48	65	(48+65) / 2 - 48 = 8.5	8.5	10.5
50	68	(50+68) / 2 - 48 = 11	11	21.5

Degree day based monitoring guidelines:

Degree day accumulation since March 1 (48°F base)	Alfalfa weevil stage	Monitoring comments
310	Egg hatch, first instars	Monitor for early detection
425	Peak of 2nd instar	Increasing population
550	Peak 4th instars	Most damaging instars present
850	Adult emergence	

resulting in a skeletonized appearance of the foliage. Severely damaged fields appear white or gray, similar to having been frosted, because of the extensive skeletonization caused by larval feeding.

Larvae can usually be found in the field from mid-May through June and even into early July. Peak populations in Montana usually occur about the time of first cutting, in early- to mid-June.

When fully developed larvae complete their feeding, they drop to the ground and construct loose, net-like cocoons incorporating pieces of leaves or other plant debris. Larvae then pupate within their cocoons (*Figure 4*), emerging 10 to 12 days later as adults. Newly emerged adults feed on alfalfa foliage for a short time before leaving the field to hibernate for the summer. There is one generation of alfalfa weevil per year in Montana.

Plant damage

The initial damage, done by young (first and second instar) larvae is not very visible. More damage is done by the larger larvae (third and fourth instar) feeding on and skeletonizing leaves. Damage by larger larvae is more visible, causing fields to appear frosted almost overnight (*Figure 5*).

Weevil larvae feeding causes both direct and indirect damage to alfalfa. Because weevils feed preferentially on leaves, and leaf tissue contributes greatly to alfalfa quality, weevil larvae directly damage alfalfa by reducing both yield and quality. Producers who are paid based on forage quality can experience reduced quality and economic returns due to untreated alfalfa weevil larvae damage.

Additionally, weevil larvae feeding can indirectly damage alfalfa. Alfalfa weevil larvae populations generally occur when growth is dependent on the plant's stored root reserves. Weevil larvae feeding during this time causes further root reserve depletion, resulting in additional stress and weakening of the plant. Heavy, unchecked weevil larvae populations feeding during the first cutting have been documented to reduce yields in subsequent cuttings. Stand longevity may also be affected.

Monitoring

Regular and timely monitoring provides information about the alfalfa weevil larvae population and whether it is increasing or decreasing when compared with previous sampling visits. Weevil larvae may be monitored using either stem or sweep net sampling. However, whichever method is used, it is important to collect a random and representative sample.

In general, field edges should be avoided, and a sample should be collected from each quadrant of a field. Patterns for collecting samples from a field are shown in Figure 6. Different sites within a field should be sampled on each field visit, and trouble spots, including droughty, wet or weedy areas within the field, should be considered separately.

Degree day calculations

Because the growth and development of the alfalfa weevil is related to temperature, a calculation based on daily minimum and maximum temperature can be used to gauge when larval monitoring should begin.

Start collecting weather data on

Cumulative degree days (DD) for some Montana locations based on 30-year temperature averages

DD since Mar 1	Sidney	Glasgow	Lewistown	Kalispell	Dillon	Bozeman	Red Lodge
310	24 May	29 May	13 June	7 June	10 June	8 June	16 June
425	2 June	6 June	23 June	17 June	20 June	18 June	25 June
550	10 June	15 June	2 July	27 June	29 June	27 June	4 July
850	27 June	1 July	20 July	17 July	17 July	13 July	21 July

DEGREE DAY FORMULA:
[(daily minimum temp. + daily maximum) / 2] - 48 = degree days

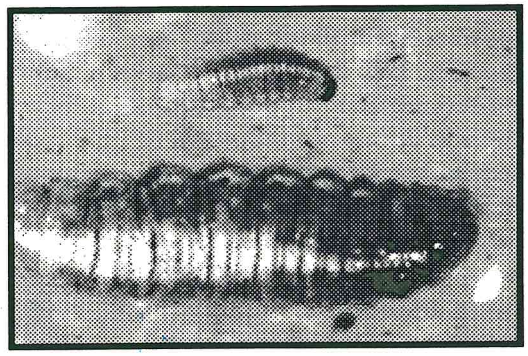

Figure 3: Alfalfa weevil larvae

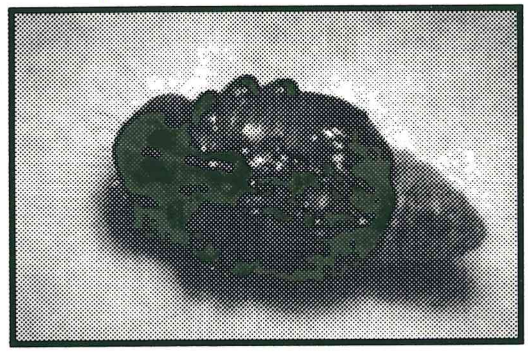

Figure 4: Alfalfa weevil pupae

Figure 5: Alfalfa weevil damage

March 1 and add degree day accumulation to the day before. When negative numbers are obtained from the calculations, 0 is used for DD for that day, since no insect growth was achieved. Temperature data can be collected on-site using a minimum/maximum thermometer, or by using local published temperatures.

In Montana, surveying for alfalfa weevil larvae should begin when 310 degree days have accumulated. Untreated weevil larvae populations generally peak when around 425 degree days have accumulated. Field visits to sample for weevil larvae and assess plant damage should be conducted weekly.

Stem sampling

Randomly select 25 stems per site by looking at the horizon and selecting a stem. This avoids the tendency to select a stem with visible weevil larvae damage. Stems are gently clipped to prevent loss of larvae, then shaken into a bucket to dislodge larvae. The number of weevil larvae per stem can then be determined for several field locations and averaged to determine the weevil larvae per stem for the entire field.

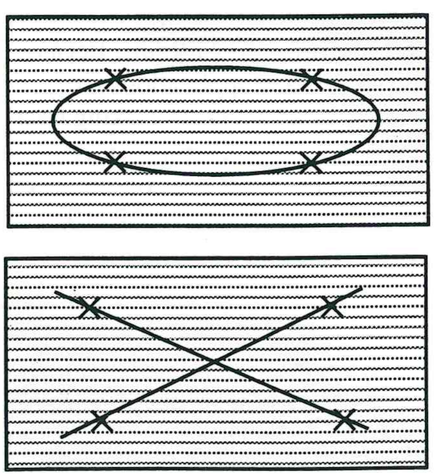

Figure 6: Collecting patterns. Avoid field edges, and collect a sample (X) from each quadrant of the field

Damaged terminals

Along with stem sampling, an estimate of the number of damaged terminals should be visually determined. Fifty terminals should be examined at each sampling location and number of weevil-damaged terminals calculated (if 50 terminals are examined and 15 are damaged, multiply by two to get the percentage, e.g., 30%).

When 30 to 50 percent of the terminals show evidence of weevil feeding, a significant population is present and larvae should be monitored closely.

Sweep net sampling

When alfalfa is at least eight to 10 inches in height a sweep net may be used to quickly estimate the population size. A standard-sized sweep net is 15 inches in diameter and should be swung through a 180° arc. The number of weevil larvae from 10-sweep samples should be counted, recorded, and repeated at each site.

Sweep nets are not efficient at collecting smaller instars, so early in the season check for percent damaged terminals to detect smaller larvae in addition to using a sweep net. The number of larvae per sweep can be averaged over all sampling locations within a field to obtain the number of weevil larvae per sweep.

As a general rule, collect a minimum of three 10-sweep samples in fields between one and 19 acres in size, four samples for fields 20 to 29 acres in size and five samples for larger fields.

Economic threshold

Practically, we tend to use economic thresholds as static population measures, but they really are not. Decision-makers should also consider the market price or value of the alfalfa hay and the costs of control.

Because weevil populations in Montana do not increase to economic levels every year, if populations are low (less than five larvae per sweep) for two weeks or more and are not increasing, increase the monitoring frequency to 100 DD or 10 to 14 days. However, if larvae are between five to 10 per sweep, recheck in seven days. If weevil larvae are between 10 to 15 per sweep, check in three or four days and be prepared to make a treatment decision. Generally, when larvae populations average between 1.5 and two larvae per stem or 20 larvae per sweep, treatment is considered to be economical. Also consider crop height, time to harvest, estimated yield, and stage of the weevil larvae population.

Cultural controls

Early cutting has been used in Montana as a method to control alfalfa weevil larvae with mixed success. Early cutting can reduce weevil larvae populations by exposing them to desiccating effects of sun and wind and disrupting their food supply.

However, early cutting does not necessarily mean that a chemical treatment is avoided. Weevil larvae can be concentrated when swathing cuts alfalfa into windrows under which the larvae are protected by a blanket of forage. Small larvae which have not yet completed their development will climb up stubble and continue to feed on developing buds. When populations are high, this can prevent green-up in strips corresponding to swaths where cut forage laid before baling.

When early cutting is used to control weevil larvae populations, check for larvae under the windrows on the regrowth one to two days after mowing. If more than eight larvae per square foot are present under windrows, then an insecticide treatment applied to stubble is suggested after the baled hay is removed.

Weevil larvae feeding underneath windrows may consume regrowth, weakening plants. In severe cases the effects may be observed on strips corresponding to first cutting swaths for the remainder of the growing season. Early cutting may also reduce yield and this should be considered in making an early cutting decision.

A variety of cultural techniques, including winter grazing, burning or flaming to control alfalfa weevil populations, have been tested in other states. These treatments work by removing stems, and with them, eggs laid by the alfalfa weevil. However, in Montana few eggs are laid until spring temperatures consistently exceed 60° F.

Grazing alfalfa when alfalfa is breaking dormancy and greening up is not recommended because of the danger of bloat, unless preventative measures are taken. Burning or flaming a field is costly and is sometimes done for weed control. There is little evidence for the control of alfalfa weevil larvae by these cultural practices in Montana and they are not recommended practices.

Cultivar selection

There are no alfalfa cultivars with adequate levels of resistance to alfalfa weevil. Some cultivars tolerate alfalfa weevil feeding better than others because of their ability to branch from stem (axillary) buds. If a terminal has been killed by weevil larvae feeding, these tolerant cultivars can compensate more quickly by developing lateral branches rather than by shoots developing from crowns.

Cultivar selection should consider a number of agronomic characteristics, including local adaptation, dormancy and desired stand longevity. There are other host plant resistance features including resistance to diseases, aphids and nematodes. These factors should be considered because of their potential contribution to productivity and stand longevity.

Biological control agents including both predators and parasitoids are present in Montana alfalfa fields. Parasitism of weevil larvae by *Bathyplectes* species has been found ranging from zero to 20 percent in Montana. While these and other biological control agents have been very effective in controlling alfalfa weevil in some eastern areas of the United States, most western states experience yearly damaging populations of alfalfa weevil larvae despite the presence of parasitoids.

It is thought that dry western climates prevent parasitoid populations from reaching effective population levels. Early cutting has a detrimental effect on *Bathyplectes* species.

Chemical controls are another alternative used to control weevil larvae populations which exceed the economic threshold levels. Because chemicals and applications are costly, avoid delays in making treatment decisions. Currently recommended chemical controls are listed in Extension Bulletin # EB110, which is updated yearly.

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